Overview: Extraordinary Times, Extraordinary Measures

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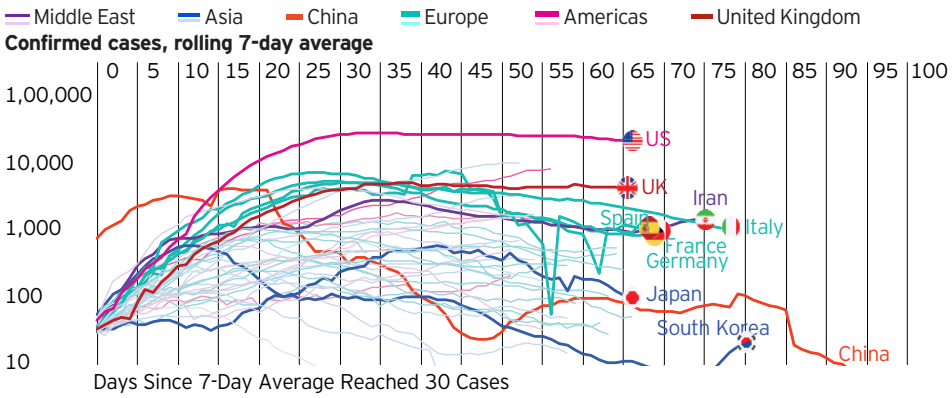
The key epidemiological data about the pandemic point to important, shared trends across countries amid major differences in national experiences. The pandemic has followed an exponential trajectory – although at very different rates around the world. It is also clear that lockdowns have "flattened the curve" of infections and fatalities in most major economies. So far, then, it seems a bad situation has been improved.

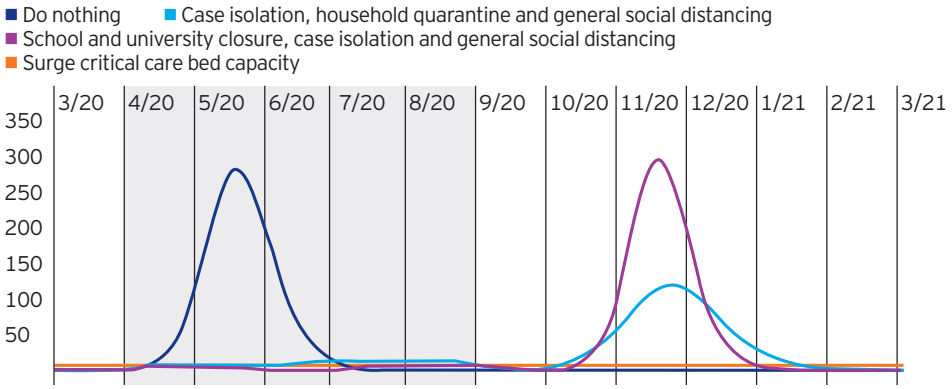
Figure 1: Epidemic curves mostly flattening in most major economies



Source: Invesco, Johns Hopkins, Data as at 12 May 2020. Vertical scale is logarithmic.

However, it seems unlikely that the pandemic's steep rise will be followed by a peak and then a mountainous collapse of exponential decline in most countries. Only China's data shows a sharp fall in cases (and deaths), followed by some imported cases. Every other country seems to have experienced a plateau, then a gradual declining trend with ups and downs. Furthermore, several Asian "First-In, First-Out" countries, after initially flattening the curve, have experienced secondary waves, whether imported or domestic. Indeed, even China, with far better results than any other large country is now experiencing a significant enough second wave that reported resumed regional lockdowns affecting some 7% of its population. These experiences in Asia suggest that releases in the rest of the world may need to be even more tentative and gradual, because their lockdowns were less timely, stringent and regionally extensive and hence curve flattening slower and less definitive. All these epidemiological factors in turn may well slow the economic recovery.

Figure 2: Stylized epidemiological models warn of a significant second wave



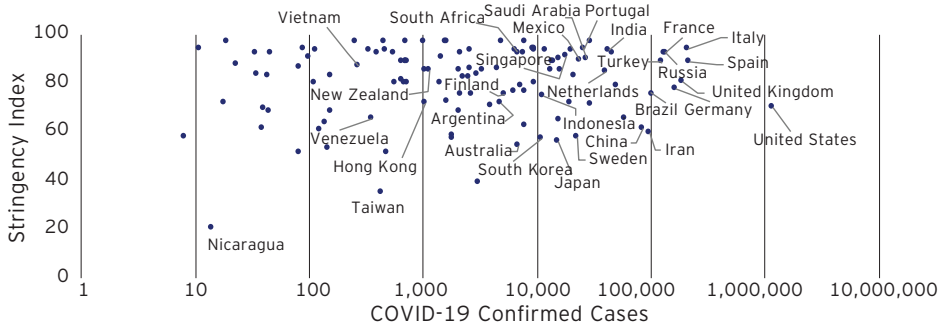
Source: Imperial College COVID-19 Response Team paper, 16 March 2020, commissioned for by No.10 for HM Government and shared with White House Coronavirus Task Force, a major swing factor in driving UK and US health policy towards lockdowns as in China, Italy, France, Spain; Invesco.

The good news is that the available information all suggests that these major economies should be able to withstand moderate secondary waves – assuming that the virus doesn't mutate significantly and that other major new facts do not come to light. There was a fear early on that the first wave and potentially second waves could overwhelm public health systems. Indeed, this is just what seems to have happened in Italy, and may account for the high concentration of recorded fatalities in Wuhan, the epicenter of the first outbreak.

The concern about an overwhelming wave from a high absolute number of severe illnesses and deaths lay behind the shift from a relatively laissez-faire approach in both the United Kingdom and United States to a more restrictive approach in the last week of March. In the middle of March, the Imperial College London COVID-19 Response Team published a paper commissioned by the UK government, immediately shared with the US White House Coronavirus Task force. This shift in approach more or less generalized the approach to the pandemic around the world – most major Western and EM economies have opted for lockdowns, though with varying degrees of stringency, enforcement and compliance.

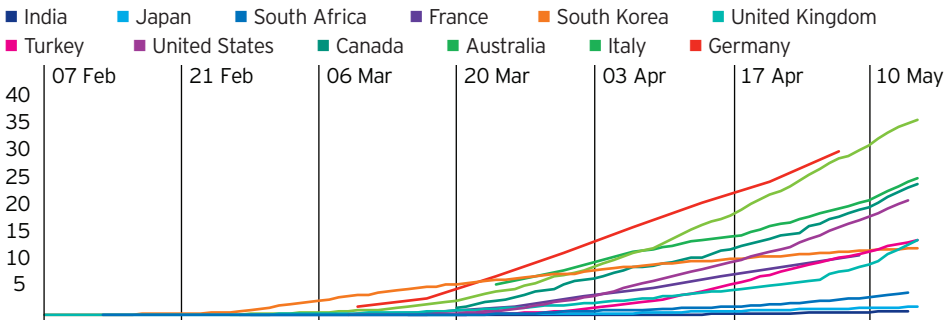
Now that the first wave seems to be passing, there are reasons to think that capacity has been improved for personal protective equipment, testing, hospital and ventilator capacity. All of these factors suggest that a secondary wave should be lower and more manageable than the first. This might be represented as a transition from the dark blue line to the light blue line in Figure 2, with the surge capacity orange line rising meaningfully going into a hypothetical second wave.

Figure 3: Lockdown Stringency and Testing Varies, with EMs generally lagging DMs



Source: Invesco; University of Oxford, Blavatnik School of Government, Oxford COVID-19 Government Response Tracker,

Coronavirus testing, tests per 1,000 people



Note: The Stringency Index tracks policies such as school closures and travel bans, and financial indicators such as fiscal or monetary measures. Horizontal scale is logarithmic with a factor base of 10.
Source: WHO, OurWorldInData.com. Data as at 4 May 2020.

Emerging Market Face a More Severe Epidemiological and Economic Threat than most DMs

The not-so-good news is that the situation in many emerging markets remains much more challenging. Testing, hospitalization and fiscal capacity are all significantly more constrained in most EMs compared to DMs, and the buildup of surge capacity for potential secondary waves is also much more constrained.

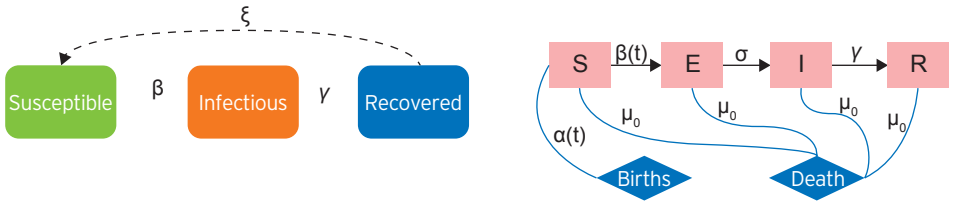
In many, social distancing is a distant prospect because of much greater congestion in urban areas with larger households – a feature of major EM economies such as Brazil, India, South Africa among others. In some, rural congestion is as much a problem as in urban areas, with large, extended-family households often with elderly and other vulnerable individuals living in constant contact. Public health policy, social distancing and fiscal support are unlikely to improve these factors in any time frame to help deal with the pandemic.

That said, the available data on the geographic spread of COVID-19 across EM does offer some hope. Iran had an earlier and more severe outbreak than most other countries, which may reflect the impact of US and EU sanctions, which is widely thought to have increased its connectivity with China. India, Russia and Brazil, in contrast, which have been ramping up testing more recently, and are now showing sharp increases in infections. All three have far lower fatality rates than most other countries (other than China, which has had by far the best results in terms of infection and fatality numbers, rates and control of any large economy).

Some EMs, such as India, South Africa and most of Africa and South Asia, have much younger average age structures and smaller cohorts of the elderly vulnerable. Fatality rates should prove significantly lower than in many DM countries. Others, however, such as Russia, Argentina and Brazil (and China itself) have aged faster. Additional "co-morbidities" appear to increase the risk of severe illness or death – such as other illnesses or weak immune systems – and are more prevalent in some countries (including in DMs), such as obesity, diabetes, lack of fitness. All of these factors probably help to explain the wide variety of infection rates, severity of illnesses and fatality rates – and help to offset negatives, such as low health-system capacity, the greater difficulty of social distancing and potentially premature lockdown relaxations.

Fatalities still appear to be quite low across all EMs. This might be due to some combination of lower vulnerability or misdiagnosis of the causes of death – a problem that has also afflicted many DMs. The United Kingdom, for example, had been counting only hospital deaths confirmed as due to COVID-19, until including deaths in old-age care homes led to a significant rise in total deaths.

Figure 4: Visualizing SIR / SEIR Susceptible, (Exposed), Infected, Recovered Compartmental Models



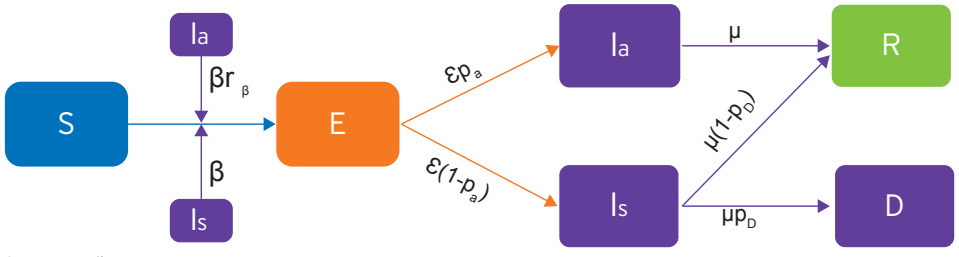
Source: Institute of Disease Modelling.

Epidemiology – more Art than Science?

Most epidemiological models of infectious diseases are variants of a simple, so-called SIR model, which divides a given "herd" into Susceptible, Infectious and Recovered compartments. Additional layers of complexity can be added as more reliable information becomes available to improve model specification. The SEIR model adds an "exposed" bucket, for example, as the stylized graphics in Figure 4. Further specificity can be added by being more specific about mechanisms and rates of transmission, and compartments.

"Essentially, all models are wrong, but some are useful"[1]: Models are abstract representations of reality, of course, with simplifications, assumptions and estimates for key variables to inform analysis and decisions. Models are rarely perfect, especially where information is incomplete and changing rapidly, as in the early stages of the exponential spread of a novel virus. Indeed, a week is a long time in a pandemic. And a key trouble with the current pandemic is that although scientists and policymakers now have a good handle on most of these variables we still don't know for sure, so we cannot be scientific or precise about what is going on. And of course, the more complex the model and hence the closer it aims to get to the reality out there, the better the inputs need to be or the wider the range of error there might be. Here is a selection of crucial known unknowns, on which scientists now have usable estimates, but not necessarily definitive answers:

Figure 5: Extending SIR/SEIR Models to include (A)symptomatic, Recovered and Deceased



Source: medium.com.

1 George Box, Fellow of the Royal Society, "Science and Statistics" in the Journal of the American Statistical Association, 1976.

Day Zero – the precise date that the virus broke into the human species, as a "zoonotic" virus from an animal host to a human host. As an addendum, Patient Zero is yet to be definitively identified. Day Zero has at various times been thought to be 31 December, 1 December, 17 November or perhaps as early as October. The starting point along with the dynamics – discussed below are crucial inputs into designing the most appropriate health policy response.

R-0 or R-Nought, the basic reproduction rate – how many people can an infectious host infect (where "nought" refers to the absence of individual or herd immunity, which is assumed to be the case when a new virus is introduced into a population on Day Zero). Effective reproductive rates are estimated from observed infections and contacts (assuming that testing and contact tracing are representative and accurate).

Case or infection fatality rates (CFR or IFR – deaths divided by infections). In the case of COVID-19, as is often the case in the early stages of novel virus outbreaks, especially where R-0, R-Eff, or Day Zero / Patient Zero have yet to be determined, it can be quite hard to determine how deadly the virus actually is.

Asymptomatic "presentation" – when individuals test positive, do not exhibit known symptoms but are (probably) infectious: Is it that we still do not know all the symptoms, and hence don't know everything to look for in a victim? Or that symptoms arise later in some cases? Are asymptomatic carriers immune?

Estimates of R-0, R-Eff and IFRs have varied widely over time, and across countries and even regions within countries. If $R > 1$, infections would rise exponentially. Indeed, it is impossible to be sure to what extent increases in infection numbers and rates and their subsequent decline is due to changing testing numbers or patterns (e.g., whether tests are random or there is deliberate "sample selection bias" to verify or falsify infection, or test front-line health workers).

If $R < 0$, then infections would fall exponentially over time, tending towards viral extinction. Of course, if lockdowns and social distancing are the main reason for declining infections – i.e., in the absence of herd immunity, a cure or a vaccine – then release would probably lead to a resurgence in infections. Such developments would be seen in infectious but asymptomatic cases contributing to earlier compartments in Figures 4 and 5 above. If immunity is not conferred via infection and recovery and instead, re-infection and illness / death can occur, R-Eff and IFR would both trend higher and would call for renewed social distancing or lockdowns, in the absence of effective vaccination or treatment.

The Curious Case of COVID-19: Broad Public Health Policy Dilemmas

Judgments about such issues and variables are crucial to help determine the best course of action: Whether to rely on "Non-Pharmaceutical Interventions" – such as lockdowns, social distancing and self-isolation to slow the spread of the disease lest public health systems are overwhelmed perhaps more than once, if there are substantial second waves? Do flatter curves reflect the temporary effect of the lockdowns themselves, such that the virus is likely to make a significant comeback following even partial relaxations?

Or if the virus had already propagated for months or a couple of quarters instead of some weeks in a highly interconnected world, before the lockdowns began, might it be better to shift gears, and instead to emphasize mass testing and contact tracing, targeting restrictions on high-risk categories; and mass "serological" testing for antibodies to establish both infection and possible immunity levels across populations? Does this amount to a judgment that herd immunity is within reach?

"Herd Immunity" vs. "Non-Pharmaceutical Intervention": An open question. Are we better off as a species, as societies, as individuals – whether from public health or economic perspectives – by allowing the virus to proceed to encourage the build-up of immunity, or by trying to maintain or restore NPIs? We don't know enough about the virus itself or its long-term impact (e.g., there may be substantial permanent lung damage for victims, even after general recovery, as is believed to have occurred with prior coronaviruses that cause respiratory difficulties).

Under these circumstances, it is probably best to be "conservative" to maintain various forms of social distancing to at least reduce risk (including isolation of the known vulnerable and minimising risk of exposure in confined, crowded spaces), personal protective equipment (e.g., masks) and be prepared for partial lockdowns (i.e., "adaptive release") should secondary waves emerge, as they have in some of Asia's "First-In, First-Out" countries.

"Endemic" vs. "Epidemic" vs. Viral Extinction: COVID-19 is probably here to stay. Can we eliminate the virus (extinction) or do we need to figure out how to live with it? – as by developing a vaccine (or even a cure) or acquiring immunity (perhaps through repeat waves or epidemic/pandemic episodes) – because it's out in the world and cannot be eliminated (that is, it will become "endemic", like seasonal flu)?

Like all else to do with COVID-19, it's hard to be sure, but the "conservative" approach, again, would likely be to expect COVID-19 to become endemic, not least because the approach in different countries has been very different. The chances of viral extinction (i.e., when R-Eff < 1 in sustained fashion) may have been achieved in easily isolated environments like New Zealand or Iceland. The only major country with data pointing to viral extinction is China, but even there, cases imported from Russia are an issue; plus the emergence of more cases including asymptomatic and domestic transmission and more deaths than originally recorded points to uncertainty. Lockdown relaxations, especially if premature when curves have yet to sustainably flatten, would probably contributed to sustaining the virus within the human population.

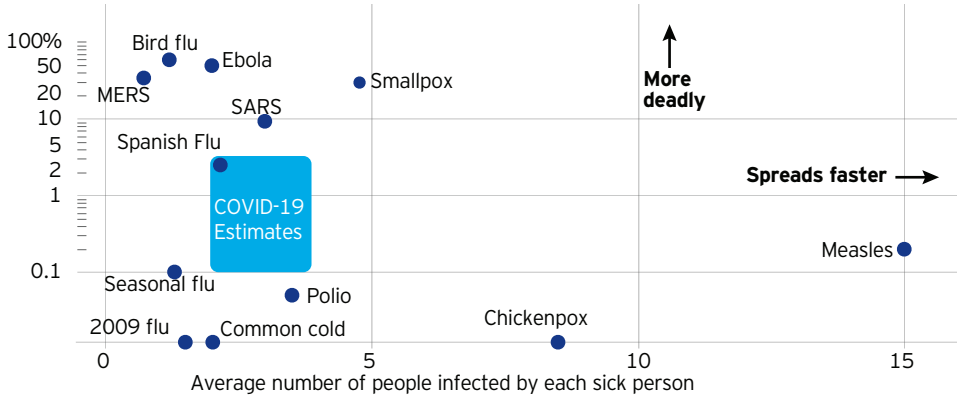
"The Cure should not be Worse than the Disease" — Assessing which requires us to know enough

Figure 6 attempts to summarize the epidemiological, medical and scientific evidence. COVID-19 seems to be significantly more lethal and infectious than the seasonal flu and is probably more infectious though less lethal than the Great Influenza Pandemic of 1918.

Though there have been several important pandemics since, the so-called "Spanish Flu" a century ago is perhaps in many respects the most important and relevant precedent. It came in multiple waves, spreading around the world, infecting perhaps 500 million – then about a third of the global population. The economic consequences of that pandemic appear to have included a contribution to the subsequent US depression of the early 1920s, which were followed by the Roaring '20s.

Though we are heading for a tentative lockdown relaxation on the basis that the worst is past, the battles to contain COVID-19 are far from over – given the prospect of periodic waves as a century ago. The remaining uncertainties suggest that the releases will remain partial and gradual — sector by sector, region by region, country by country; and very different from country to country in terms of timing and extent.

Figure 6: Pandemic Present and Past – Great Influenza Pandemic of 1918-19 as a Precedent



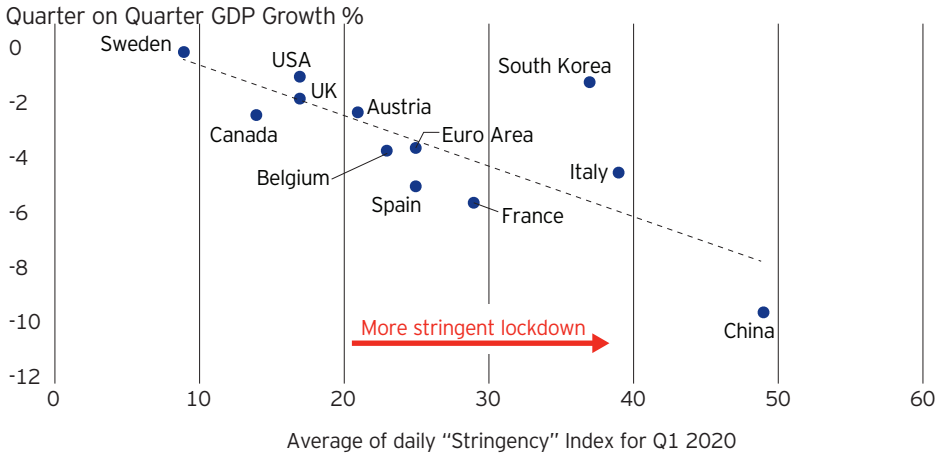
Source: Philosophical Transactions of the Royal Society, World Health Organization, New York Times, Invesco. Estimates based on preliminary data as of 29 March 2020.

Furthermore, the response in public confidence and behavior will also be very differentiated, based on the degree of trauma; national demographic characteristics including age structure and vulnerability to infection, illness and death (or the lack of it); and credibility in testing, treatment and containment regimes.

Differences in social and cultural factors have probably contributed to differences in first-wave infections and mortalities. Japan, for example, may benefit from greetings that do not include handshakes, hugging or kissing – unlike say the US, UK, Italy, Spain, France. Germany may have benefitted in its very low death rates compared to say Italy, despite a similar demographic structure because the elderly are less integrated with younger generations. Physical geography will probably also matter. Small, isolated islands like Iceland and New Zealand have probably benefitted from the combination of remoteness, small size, relative homogeneity and ability to engage in national self-isolation and relatively advance medical and public health capacity. Larger, more geographically diverse yet more interconnected economies are likely to have. All these factors, which are structural, may well point to diversity in any second waves as they probably have in the first wave.

Governments are choosing to relax the NPIs required to contain COVID-19 well before a cure or vaccine is ready — though there is progress. Already, many treatment and vaccine candidates are in trial in China, Europe and the United States, though mass use is probably some quarters away. Developing a vaccine normally requires 12-18 months and no vaccine has been ready for mass production and use in less than four years of development. That said, the race is on both among private firms and official agencies on all aspects of the sciences involved — genetics and virology towards vaccination, medicine for treatment and cure as well as refining NPIs to better deal with the current outbreak, any future waves or mutations. While the "silver bullet" of a cure or vaccination cannot be either a public health policy or an economic recovery strategy, if and when it does come, it would help significantly.

Figure 7: A "Great Compression" in GDP began in Q1, roughly in line with Lockdown Stringency, Length



Source: ONS/Oxford COVID-19 Government Response Tracker (OxCGRT), National Statistics Institutes of selected countries

Conclusion – Linking Epidemiology and Economics: A "Great Compression" and "Square-Root Recovery"

The lockdowns have precipitated a global Great Compression of economic activity – a deliberate public policy choice to sacrifice growth, national income, private wealth and public debt ratios for public health, as large, upfront, societal life insurance premium. This Great Compression is thus very different from the Great Recession, precipitated by a financial crisis and contained by fiscal and monetary easing; it is also very different from a Great Depression – the result of the opposite policy choices, to allow financial crises to cascade, not to loosen policy, even to tighten it at times.

Were these extraordinary measures worth it? Probably too early to say – but the inadequacy of the information early on and the downside risks both to public health and the economy due to the uncertainty suggest that the verdict of history should be that it was the only responsible thing to do. Plus, we have made progress in testing, treatment and capacity which should help us absorb future waves much better than the first wave of COVID-19. This progress suggests that future, "adaptive lockdowns" will very probably not need to be nearly as severe as the first effort.

The more stringent the lockdowns, the steeper the decline in activity over the course of Q1 – confirming the nature of the downturn as a great compression – as per Figure 7. We would expect the data for Q2 to show a similar pattern, with many major economies moving from the upper left to the lower right in stringency and in a steeper GDP decline. As the lockdowns are released, some but not all of this effect is likely to reverse.

The Great Compression to be followed by Gradual, COVID-Constrained Recovery. The variety of testing rates and practices, lockdown stringency levels across countries and regions points to a staggered, potentially halting or even reversible, re-opening of economic activity. Though testing hit ratios in many countries are stable, the complement of tests that have been done so far are skewed towards symptomatic cases, frontline health workers and travellers, intended to verify (or falsify) infection, rather than a truly random sample. Some have suggested that infections in large countries with now high testing rates may be as high as 10 times the confirmed numbers – perhaps as high as 20 times in some countries or regions. Such high multiples and variations have ambiguous implications for both the epidemiology and economics, for they may imply that virus spread may be running its course, implying limited further risks to public health systems; or alternatively that illnesses and mortalities may rise again as lockdowns are released, in turn spurring the need for renewed lockdowns or isolation of vulnerable groups, as well as shocks to public confidence. These uncertainties may weigh on the speed and extent of the recovery as lockdowns are released.

Looking forward, then, based on our central expectation of gradual, partial, sectoral and regional releases with downside risks of moderate secondary waves, we would expect the path of GDP to look like what we have elsewhere called a "square-root" recovery – a sharp downturn, almost free fall in activity, stabilised by fiscal and monetary support and the need to sustain basic needs; a limited release in pent up demand; and a levelling off given the constraints to complete or synchronised re-opening, given the variety of experiences of the pandemic and policy responses. We will follow up with further efforts to process the recent economic data and to translate the now unfolding partial lockdown releases into more granular views on recovery, as well as structural, thematic views on the longer-term outlook.

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